CARIBOO FOREST REGION RESEARCH SECTION

Extension Note

"Making Research Work for You"

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RESEARCH ISSUE GROUPS

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Cariboo Forest Region, BC

REHABILITATION OF BACKLOG LANDINGS: A CO-OPERATIVE PROJECT BETWEEN LIGNUM LTD. AND THE CARIBOO FOREST REGION RESEARCH SECTION

INTRODUCTION

In 1996, Lignum Ltd. proposed to undertake large scale backlog landing rehabilitation with FRBC funding. District Managers in the Forest Districts in which Lignum proposed to work, were concerned that there was little evidence available to show that backlog landings could be brought back into tree production. The Districts asked the Research Section of the Cariboo Forest Region to work co-operatively with Lignum to design a research trial that would be scientifically valid. A trial would provide good practical information on whether or not backlog landings could be rehabilitated, where landing rehabilitation would be likely to be successful, which techniques were most effective and if the rehabilitation was financially feasible. During discussions with various interested parties, other issues were identified. Concern was expressed that the landing rehabilitation would lower grass production, that critical landings used for cattle movement would be lost to those uses and that cultivated landings would be predisposed to infestation by noxious weeds.

After monitoring the first years installations, it became clear that cattle damage to seedlings was going to be one of the major obstacles to successful reforestation (Table 5). A consultant, Jeff Allen of Wells Gray Forestland Reclamation Group, Clearwater, B.C., was hired to develop strategies that would limit cattle damage on reclaimed landings and in the third year of the trial, 184 landings were rehabilitated with specific cattle control strategies. Also, in 1998 Chuck Bulmer, the B.C. Ministry of Forests

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Soil Restoration Ecologist, also became involved in the trial, doing more detailed monitoring of soil properties on some of the landings.

OBJECTIVES

1. To determine if backlog landings in the Cariboo Forest Region can be brought back into tree production.
2. To determine which landing rehabilitation techniques are most effective for particular climatic and soil conditions.
3. To determine if backlog landing rehabilitation can be done cost effectively.
4. To determine if there are methods, short of fencing, that can be used to limit cattle damage to seedlings on rehabilitated landings.
5. To monitor cattle use and noxious weed levels.

TRIAL DESIGN

A large number of treatments were incorporated into this trial (Table 1).

With so many treatments it would soon have become very confusing if multiple treatments were applied to each landing. Therefore, we chose to apply only one treatment to each landing, or, in a few cases, landings were split where comparisons between treatments on similar conditions seemed likely to be more critical. The original intent was to have each treatment on at least five different landings. Occasionally, operational difficulties resulted in fewer replications. The more practicable seeming cultivation treatments were used frequently as the foundation for comparing other types of treatments. We tried to establish trials in as wide a range of biogeoclimatic conditions as possible, but were limited to a certain extent by a desire to keep the landings in Lignum's "traditional operating area". The trials were placed in five different biogeolimatic subzones.

Table 1: Summary of Treatments

Treatment Type	Treatment Types Evaluated
Cultivation	25
Fertilization	5
Mulches	4
Shrub Plantings	6
Grass Planting	4
Cattle Management	11
Brush Mats	1

TRIAL IMPLEMENTATION

The trial was designed jointly by Lignum Ltd, Inland Timber and the Research Section of the Cariboo Forest Region. Work was done by contractors selected by Lignum Ltd and all trial installation was supervised by Derek Hodgkins of Inland Timber. Sites were photographed, locations carefully marked on maps and careful records made of each installation. The MOF spot checked treatments to see if they were meeting specifications and assured that design integrity was maintained in the face of operational realities.

MONITORING

As part of the arrangement reached among the MOF, Lignum and FRBC, Lignum agreed to monitor the landings for the first two years following treatment. After that, the responsibility for monitoring reverts to the Research Section of the Cariboo Forest Region.

During cultivation operations, work and travel times were

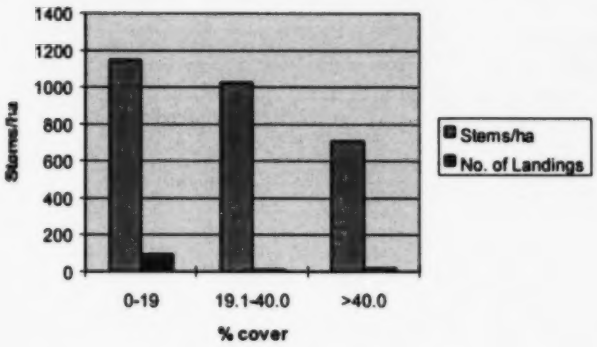

Fig. 1: Seedling Survival vs. Vegetation Cover

carefully recorded. Time studies were conducted by the Forest Engineering Research Institute (FERIC) on a number of the decompaction treatments.

Monitoring of soil bulk densities and vegetation was conducted by Inland Timber. Three bulk density locations were identified systematically on each landing (unless there was more than one treatment per landing). One bulk density was also taken from an undisturbed area adjacent to the landing. One bulk density location on the landing served as the centre point for a 5.64 metre vegetation assessment plot. Vegetation within plots was tallied by type and percent cover—care was taken to note the presence of noxious weeds. Seedling survival and condition within the plots was recorded with particular attention to potential cow damage. The number of cow pies within each plot was tallied as a indicator of cow use.

The plots installed in the first year have been monitored twice, those in the second year have been monitored once and the plots installed in the third year have not yet been monitored.

RESULTS

Seedling Establishment: Generally, seedling survival and quality after 1 year (Table 2) and after two years is good. For the first and second year, mortality rates were not much different from those found in normal plantations and landings

Table 2: Average stocking levels by biogeoclimatic zone for landings planted in 1997 compared to the Free Growing Minimum Stocking Standards

Biogeoclimatic Zone	1997 Stocking Average (st/ha)	1998 Stocking Average (st/ha)	% change	Minimum Stocking Standards[1] (st/ha)	% of landings that exceed Minimum stocking standards[1]
IDFdk3	1366	1115	-18.3	600	95.5
SBPSmk	1217	796	-34.6	600	83.3
SBSdw2	1180	1022	-13.4	600	76.5
All Treatments	1312	1073	-18.2	600	88.5

[1] From Establishment to Free Growing Guidebook – Cariboo Forest Region, April 1995

remain well stocked. The only exceptions were the landings in the SBPS where first year mortalities were high, but the sample size was small for this zone and the observations could be of an anomaly. In general, cow damage was the single largest cause of mortality. There is an inverse relationship between vegetative cover and seedling survival (Fig. 1).

Seedling Growth: Generally, seedling growth is not significantly different from that found in normal reforestation situations. By the third year, seedlings on many of the landings are showing good leader growth and good condition.

Soil Bulk Density: Table 3 compares the bulk densities one and two years after decompaction to soil bulk densities that were normal for the area. In most cases there were insignificant differences between the rehabilitated landing bulk densities and the bulk densities of the surrounding undisturbed soils. In only three out of eleven types of treatments were there significant increases in bulk density from year one to year two. The bulk densities need to be monitored over the longer term because they still have the potential to change, but the relatively slow rates of change for most of the treatments seem to suggest that this is unlikely. At least one treatment, the broadcast Silva Tiller has resulted in a considerable improvement in soil density.

Noxious Weeds: Only three landings had noxious weeds on them (Canada thistle and Oxeye Daisy) and the cover did not exceed 1.5% on any landing after 2 years.

Economic Analysis: Cultivation costs varied enormously ($200-$2600/ha) but were, usually, by far the highest cost component of rehabilitation. Table 4 shows the costs for two types of treatments. Up to present, there is little difference between the treatments in terms of seedling growth and survival and results are suggestive that, for the most part, the cheapest treatments can be used in most situations.

Some treatments were different in some ways. The

Table 3: Average bulk densities one and two years after decompaction for landings treated in 1996 compared to average undisturbed bulk density.

Treatment 1	Treatment 2 (if any)	1997 Average (g/cm^3)	1998 Average (g/cm^3)	Undisturbed Average (g/cm^3)
5-Tooth/Excavator		1.18	1.15	1.18
Mod. Rip Deep		1.08	1.21	1.19
Mod. Rip Shallow		1.10	1.14	1.09
Rip Deep		1.21	1.20	1.26
Rip Shallow		1.15	1.17	1.30
Silva Tiller		1.11	1.24	1.13
Silva Tiller – Broadcast		.95	.92	1.26
Mod. Rip Deep	5-Tooth/Excavator	1.13	1.14	1.09
Rip Deep	5-Tooth/Excavator	.94	1.23	1.27
Rip Shallow	5-Tooth/Excavator	1.05	1.20	1.28
Mod. Rip Deep	Silva Tiller/Patch	1.15	1.18	1.13
All Treatments		1.13	1.18	1.19

Table 4: Sample maximum and minimum landing rehabilitation costs per 0.25 hectare landing from 1996-1998.

	Treatment	Cost
Minimum cost	Equipment mobilizaton	$100
	Cultivation w/ Disc trencher on skidder	$54
	Planting conifers with teabags	$432
	Total	**$586**
Maximum cost	Equipment mobilization	$100
	Cultivation w/ Crawler tractor – berms	$640
	Fertilization	$140
	Planting shrubs	$75
	Planting conifers	$372
	Total	**$1372**

Equipment mobilization includes the transportation of the decompaction equipment to the area via lowbed and the machine time spent walking equipment between landings

broadcast Silva Tiller cultivation was most successful at lowering bulk density and could be used on frozen or wet ground. Some cultivation treatments seemed better at achieving short term vegetation control.

An economic analysis report was prepared by the MOF Research Section. One significant finding is that when comparing landing rehabilitation to other silvicultural investments, it has to be taken into account that successful landing rehabilitation will result in a tree crop where there would have been none. Most silvicultural treatments only result in some incremental increase in productivity or establishment success. In this light, reasonably priced landing rehabilitation is not much different from other silvicultural treatments as a financial investment.

Cow Damage: Table 5 shows that cow damage is a major consideration. Cow damage did not occur uniformly across all landings but is more likely to be severe where cow use has been high in the past.

Many novel practises were implemented in 1999 to attempt to reduce cattle damage, including planting on berms or mounds, protecting seedlings with foam collars, planting willows or hawthorne beside seedlings to make the seedlings more obvious to cows, using woody debris as obstacles, planting pinegrass and other less palatable grasses and others. It is too early to determine success other than to say that seedlings have been successfully established on the raised microsites, even in the IDF. Pinegrass germinated well this fall and many of the willows have sprouted and appear to be doing well.

There is a fairly strong inverse relationship between seedling survival and vegetative cover. Wetter areas tended to have much more rapid recovery of vegetation after cultivation and higher cattle damage. There appears to be a difference between cultivation treatments in terms of vegetation control. Selecting landings based on moisture regime and cultivating to control grasses could have potential to reduce cattle damage.

Table 5: Percent of seedlings damaged by cattle

Year Planted	Year/Season Monitored	%seedlings damaged	%seedlings in poor condition
1997	1997 Fall	6.5	
	1998 Fall	45.8	8.3
1998	1998 Fall	14.9	1.8

SUMMARY

While results are still short term we can say that a wide range of cultivation techniques appear to have worked well over a wide range of soil and climatic conditions. Seedlings have been established and are growing well. If they looked as good in normal reforestation situations, one could be very optimistic that the areas were going to be successfully reforested. Cow damage is the single biggest risk. Until results are known from the trials to lessen cow damage, it would be best to avoid rehabilitating landings with a history of heavy cattle use. Alternatively, it appears that cow damage can be reduced somewhat by careful selection of landings that are not currently used heavily by cattle, by cultivating to control vegetation or by selecting landings that are likely to have slower vegetation recovery.

Two detailed reports have been prepared by Inland Timber Management Ltd. for Lignum Ltd. In addition, an economic analysis report and a summary report have been prepared by the Research Section. Copies of any of these reports can be obtained from the Research Section of the Cariboo Forest Region.

Figure 2: Happy 3 year old trees on a rehabilitated landing

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